

Novelties of the Genera *Parajubaea* and *Syagrus* (Palmae) from Interandean Valleys of Bolivia

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ABSTRACT. Two new species from the interandean valleys of Bolivia, *Parajubaea sunkha* and *Syagrus yungasensis* (Palmae), and a new variety, *Parajubaea torallyi* var. *microcarpa* (Palmae), are described and illustrated.

RESUMEN. Se describen e ilustran dos nuevas especies de Palmae de los valles interandinos de Bolivia, *Parajubaea sunkha* y *Syagrus yungasensis*; también se describe la variedad *Parajubaea torallyi* var. *microcarpa*.

Recent intensive fieldwork, new palm collections, and the preparation of a Bolivian palm flora have increased information about the richness and distribution of Bolivian palms. The descriptions of two new species and one variety are included in treatments of the Bolivian palm flora by Moraes (in prep.).

PARAJUBAEA BURRET

Parajubaea is a small genus occurring in the interandean valleys of southern Colombia, central Ecuador, and central to southern Bolivia. All species are treelike, with pinnate leaves, and branched interfoliar inflorescences. The genus was studied by Moraes and Henderson (1990), and two species were recognized: *P. cocoides*, growing in cultivated stands of Colombia and Ecuador, and *P. torallyi*, endemic to Bolivia. The latter species was not well understood nor looked for in other areas of Bolivia. The genus *Parajubaea* now includes a third species and two varieties, which are treated in the present contribution.

Parajubaea torallyi has been recorded from the northeastern area of the Chuquisaca department, in southern Bolivia. Moraes and Henderson (1990) added another collection for this species from the southwest of the department of Santa Cruz, but this is treated here under a distinct species, *P. sunkha*.

KEY TO THE SPECIES OF PARAJUBAEA

1. Rachillae with short side branches; staminodial ring with three fingerlike projections; endocarp with three inconspicuous ridges; cultivated; Co-

- lombia and Ecuador, between 2500 and 3000 m *P. cocoides*
1. Rachillae unbranched; staminodial ring not digitated; endocarp with three prominent or inconspicuous ridges; wild populations; Bolivia, between 1700 and 3400 m.
2. Pinnae irregularly arranged; sheath fibers well developed; stem 4–10 m tall, 25–35 cm diam., densely covered by sheaths; in protected ravines, between 1700 and 2200 m *P. sunkha*
2. Pinnae regularly arranged; scarce fibers on sheath; stem 20–26 m tall, 25–50 cm diam., smooth; on steep slopes, between 2700 and 3400 m *P. torallyi*

Some similarities are found between *Parajubaea cocoides* and *P. torallyi*, such as in habit (e.g., smooth and tall stems, long petioles, and regularly arranged pinnae). The single seed-fruit and less obvious endocarpic ridges are characteristics of both *P. sunkha* and *P. cocoides*.

Parajubaea sunkha Moraes, sp. nov. TYPE: Bolivia. Santa Cruz: Vallegrande, El Palmar, 26 km on road from Vallegrande to Postrer Valle, 2400 m, 22 Aug. 1994, M. Moraes & I. Vargas 1805 (holotype, LPB; isotypes, AAU, NY, QCA, UCZ, US). Figure 1.

Caudex solitarius 4–10(–14) m, cum reliquiis foliaris basis. Petioli valde fibrosi, 33–100 cm longi; pinnae utroque latere 66–92, irregulariter dispositae vel 2–5 inter se obscure aggregatae. Flores masculini staminibus 13–15; flores feminei 4–5(–8) ad rachillae basim. Fructus ovoideus 3–5 cm longus; putamine 1(–2).

Stem 4–10(–14) m tall, 25–50 cm diam., covered to the base with old sheaths. Leaves 18–26, 2–3 m long, erect and arching in distal third portion; sheath 35–120 cm long, with a dense tough brown fiber 1–1.35 m long, 40–70 cm wide; petiole 33–100 cm long; rachis 2–2.5 m long, triangular in cross section at apex; pinnae 66–92 per side, lanceolate, irregularly inserted in groups of 2–5, 3–4 cm apart, in one plane, plicate at base, green and lustrous adaxially, glaucous abaxially; basal pinnae 45–80 × 0.4–1.1 cm; middle pinnae 62–70 × 2.5–3 cm; apical pinnae 40–52 × 0.3–0.8 cm. Inflorescences up to six per plant, 1.8–2.5 m long, buds erect becoming pendulous at anthesis; prophyll ca.

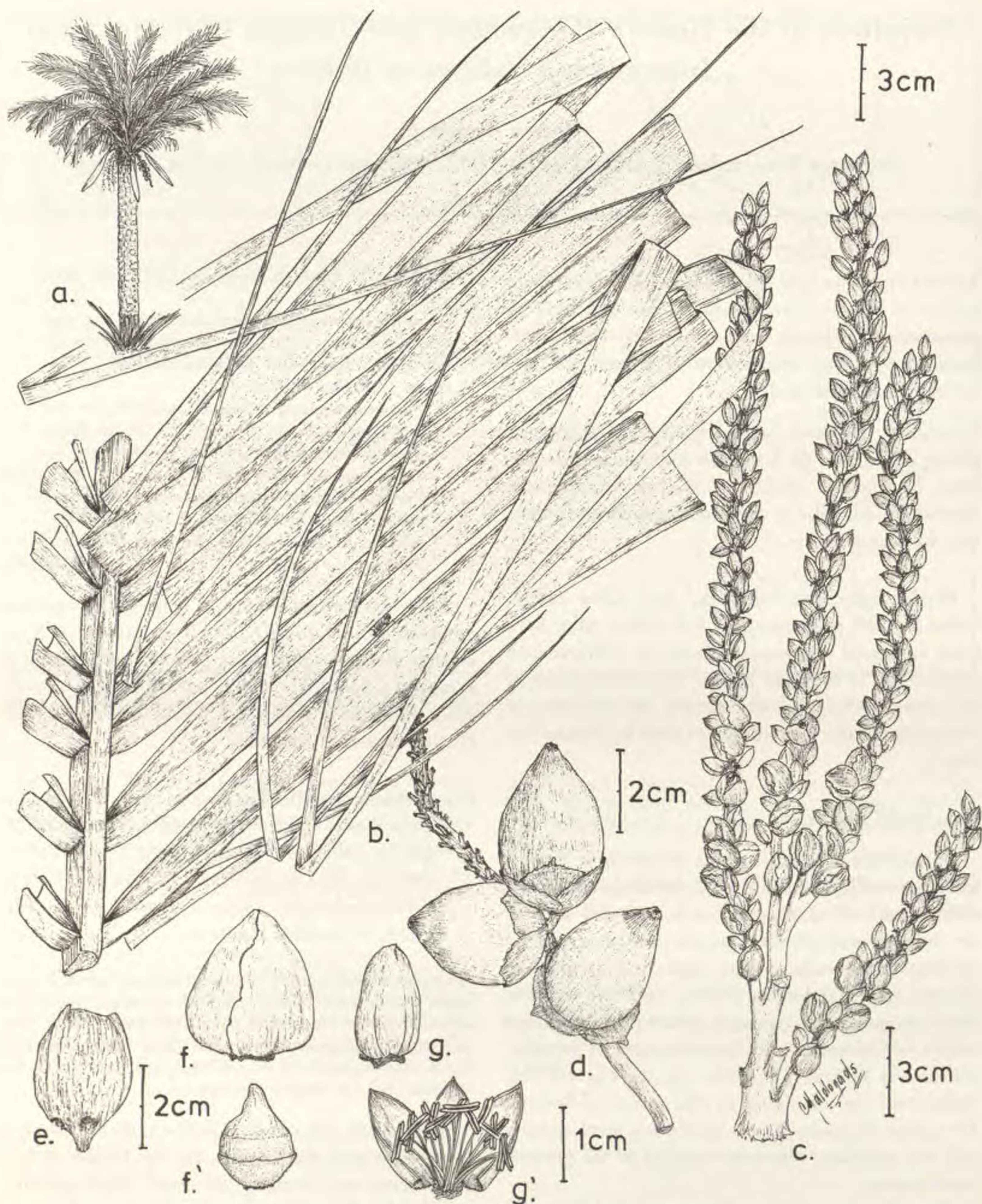


Figure 1. *Parajubaea sunkha* Moraes. —a. Habit with persistent sheaths. —b. Shape and arrangement of leaves, grouped pinnae. —c. Inflorescence, apical portion. —d. Infructescence with mature fruits. —e. Endocarp. —f. Pistillate flower. —f'. Ovary with staminodial ring. —g. Staminate flower. —g'. Open perianth showing stamens. (a based on photographs taken in El Palmar and Mataralcito, Santa Cruz; b–g on Moraes & Vargas 1805.)

1.4 m long and 13 cm diam. at base; peduncular bract 0.85–1.75 m long, apiculate, inflated above, woody, sulcate, brown externally, glabrous and white-cream internally; peduncle 60–80 cm long, glabrous; rachis 38–50 cm long, glabrous; rachillae

33–50 spirally arranged, spreading at anthesis, the basal ones 18–32 cm long, the middle ones 28 cm long, the apical ones 21–25 cm long; staminate flowers pedicellate, pedicel 2–6 mm, yellow-orange; sepals free, briefly connate basally; petals

broadly triangular, 10×6 mm, valvate; stamens 13–15, 6 mm long; filaments 2 mm long; anthers 4 mm long, medifixed, slightly sagittate; pistillode trifid; pistillate flowers 4–5(–8) per rachilla, basally inserted, 8.5×10 mm; sepals and petals broadly triangular, 10×13 mm, petals slightly smaller than sepals; staminodial ring to 2 mm tall, with 6 short teeth; ovary brownish beige tomentose; stigmas to 1 mm long; ovule basal. Fruit ovoid, 3–5 cm long, 2.5–3 cm diam.; epicarp light green, orange at apex; mesocarp very fibrous; endocarp stonish, brown with 3 inconspicuous ridges; seeds 1(–2), 2–2.5 cm long; endosperm homogeneous with central cavity; eophyll bifid.

Etymology. The vernacular Aymaran name of *sunkha*, which refers to the density of fibers, has been adopted for the species epithet.

Common names. “Sunkha,” “palma sunkha,” “corozo.”

Uses. This palm is exploited locally: fibers are collected for ropes, mattresses, and pads; leaves and leaflets for fans and baskets; fruits for human consumption; palmheart and young leaves for forage (Moraes & Henderson, 1990; Vargas, 1994).

Distribution. Endemic to Bolivia. Restricted to narrow valleys with low semideciduous forests in the lower parts and with *Podocarpus parlatorei* Pilger, *Alnus acuminata* HBK, and *Berberis* sp. in the upper parts, partially transformed to grassy or shrubby slopes and ridges, in the Department of Santa Cruz, Province of Vallegrande ($63^{\circ}26' - 64^{\circ}10'W$, $18^{\circ}10' - 18^{\circ}30'S$). Populations occur between 1700 and 2200 m elevation in interandean dry valleys. It is locally abundant in protected ravines, but most of the population is being reduced by the cultivation of maize. This palm is much less common today than 50 years ago. Several local people referred to a formerly larger area of the sunkha palm that extended to the south of Vallegrande.

Conservation status. Due to the restricted distribution of *Parajubaea sunkha*, and the harvesting of fiber and leaves, this species is endangered.

Paratypes. BOLIVIA. **Santa Cruz:** Prov. Vallegrande, Mataralcito, 2 hours E of Santa Rosita on road to Postrer Valle, $18^{\circ}32'S$, $64^{\circ}00'W$, 1900 m, 11 May 1988, Henderson, Moraes & Saldias 760 (LPB, NY), 10 May 1988, Moraes et al. 1048 (LPB, NY); 15 km E from Santa Rosita, 23 July 1989, Vargas 230 (LPB, UCZ); 10 km E of Guadalupe, valley of río Piraymiri, 1 km upstream from Chorillos, $18^{\circ}33'S$, $63^{\circ}59'W$, 1800 m, 5 Feb. 1988, Nee et al. 36179 (LPB, NY, UCZ); in Barrio Nuevo, $18^{\circ}29'S$, $64^{\circ}06'W$, 2000 m, 5 Feb. 1988, Nee et al. 36245 (LPB, NY, UCZ).

Much material previously cited was misidentified as *Parajubaea torallyi* (Moraes & Henderson,

1990), to which the new species *P. sunkha* is undoubtedly closely related, and with which it is wholly allopatric.

Parajubaea torallyi is a tree 20–26 m tall, with a smooth and slender stem, and pinnae regularly arranged. It grows on steep western slopes of sandstone mountains ranging from 2000 to 3400 m. There are two populations, which differ in fruit size, shape of endocarp, and number of stamens. They are treated as two varieties of *P. torallyi*.

KEY TO THE VARIETIES OF *PARAJUBAEA TORALLYI*

1. Fruits 6–7.5 cm long with 2–3 seeds; endocarp with 3 prominent ridges; rachillae straight; stamens 17. *P. torallyi* var. *torallyi*
1. Fruits 4–5 cm long with 1(–2) seeds; endocarp with 3 inconspicuous ridges; rachillae zig-zag and twisted; stamens 13–15 . . . *P. torallyi* var. *microcarpa*

The zig-zag and twisted rachillae shape of *P. torallyi* var. *microcarpa* is reminiscent of *P. cocoides*.

Parajubaea torallyi (C. Martius) Burret var. **microcarpa** Moraes, var. nov. TYPE: Bolivia. Chuquisaca: Jatun Palmar, Palmar Grande, 10 km E of Soroma, ravines of río Pilcomayo, 2047 m, 26 May 1995, M. Moraes, E. Oviedo & O. Murguía 2209 (holotype, LPB; isotype, NY). Figure 2.

Flores masculini staminibus 13–15; flores feminei 1(–2) ad rachillae basim. Fructus ovoideus 3.5–4.5 cm longus; putamine 1(–2).

Stem 10–20 m tall, 25–50 cm diam., smooth. Leaves 15–18, 4.5–5 m long, erect; sheath to 110 cm long, with few fibers to 15 cm long; petiole 70–90 cm long; rachis 2.7–3.2 m long, triangular in cross section at apex; pinnae 80–89 per side, lanceolate, regularly inserted and spreading in the same plane, plicate at base, green and lustrous adaxially, glaucous abaxially; basal pinnae 56–75 \times 0.6–1 cm; middle pinnae 60–65 \times 1.2–1.5 cm; apical pinnae 68–72 \times 0.8–1 cm. Inflorescences up to five per plant, 1.8–2.5 m long; buds erect, becoming pendulous at anthesis; prophyll ca. 1 m long; peduncular bract 1.1–1.3 m long, apiculate, inflated above, membranous, sulcate, brown externally, glabrous and light brown internally; peduncle 60–64 cm long, glabrous; rachis 40–46 cm long with a zig-zag and twisted shape, glabrous; rachillae 13–16 spirally arranged, spreading at anthesis, the basal ones 13–15 cm long, the apical ones 17–19 cm long; staminate flowers pedicellate, 6–9 mm long; pedicel 1–4 mm long; sepals free, briefly connate basally; petals broadly triangular, valvate; stamens 13–15, 5 mm long; filaments 3 mm long; an-

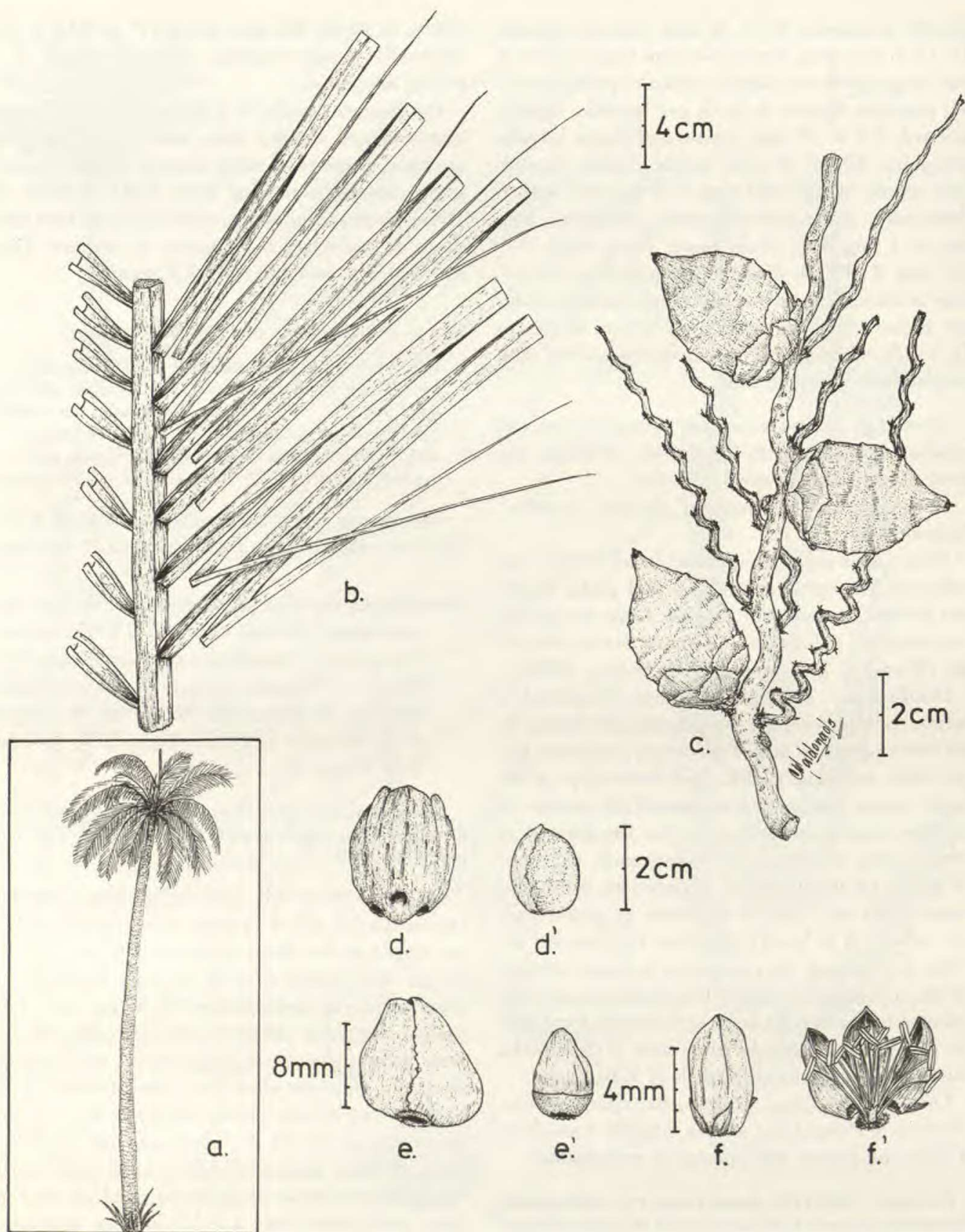


Figure 2. *Parajubaea torallyi* (C. Martius) Burret var. *microcarpa* Moraes. —a. Habit with smooth and slender stem. —b. Shape and arrangement of middle section of leaves. —c. Infructescence with mature fruits; note zig-zag shape of rachillae. —d. Endocarp. —d'. Seed. —e. Pistillate flower. —e'. Ovary with staminodial ring. —f. Staminate flower. —f'. Stamens. (a based on photographs taken in Jatun Palmar, Potosí; b–f on Moraes et al. 2209.)

thers 2 mm long, medifixed, slightly sagittate; pistillode trifold; pistillate flowers 1(–2) per rachillae, basally inserted, 8–12 mm long; sepals and petals broadly triangular to 9 mm long, petals

slightly smaller than sepals; staminodial ring to 2 mm tall, with 3 short teeth; ovary brownish beige tomentose; stigmas to 1 mm long; ovule basal. Fruit ovoid 3–5 cm long, 2.5–3 cm diam.; epicarp light

green, orange at apex; mesocarp very fibrous; endocarp with 3 inconspicuous ridges; seeds 1(-2), 2.1 cm long.

Etymology. The epithet refers to the small size of fruit, compared with *P. torallyi* var. *torallyi*.

Common names. "Janchi coco," "palma de fruto chico."

Uses. According to local people, this palm is utilized for its fruits. Formerly, the stems were split in two and then cut into pieces 1 m long, in order to extract and grind the internal fibers with an ax, and finally to weave ropes from the fibers. Occasionally, baskets and fans are made from the leaves.

Distribution. Endemic to Bolivia. Restricted to steep interandean valleys with xeric, often spiny vegetation (*Prosopis*, *Aspidosperma*, bromeliads), in the departments of Chuquisaca (Zudañez) and Potosí (Province Linares): (64°11'–64°55'W, 19°33'–19°50'S). Monotypic stands are found between 2700 and 3400 m elevation.

Conservation status. This species is not threatened because it regenerates prolifically and because there are few roads and human settlements.

Paratypes. BOLIVIA. Potosí: Prov. Linares, Jatun Palmar, 167 km E from the city of Potosí on road to Turuchipa, 19°50'S, 64°55'W, 2750–3300 m, 5 Apr. 1993, Torrico & Peca 337 (BOLV, LPB).

Parajubaea torallyi (C. Martius) Burret var. ***torallyi***, Notizbl. Bot. Gart. Berlin-Dahlem 11: 50. 1930. *Diplothemium torallyi* C. Martius in d'Orbigny, Voy. Amér. mér. 7(3). Palmiers 105, t. 15, fig. 3. 1842. *Jubaea torallyi* (C. Martius) H. A. Wendland in Kerch., Palmiers 247. 1878. *Polyandrococos torallyi* (C. Martius) Barbosa Rodrigues, Contr. Jard. Bot. Rio de Janeiro 1: 8. 1901. TYPE: Bolivia. Chuquisaca: Oropeza, Garcilaso, near town, *A. d'Orbigny* 51 (holotype, P).

The type collection consists only of endocarps that are smaller than those from Pasopaya stands. Alcides d'Orbigny gathered them from cultivated trees grown in Garcilaso, which lies in the north of the city of Sucre. These five trees still are alive and were estimated to be more than 300 years old.

When Cárdenas (1970) described the palm forests of the Bolivian high Andes, he noted two different fruit sizes of the Bolivian endemic species of *Parajubaea*, *P. torallyi*. Moraes and Henderson (1990) reviewed the genus *Parajubaea* and concluded that different fruit sizes were probably due to variation within the wild species. Further fieldwork and new measurements were undertaken in Bolivia to determine if these were two species of

Parajubaea or merely a variability within a single species. Moraes and Vargas (1994) preferred the two species hypothesis, with a distinct pattern of distribution for each. Finally, there are three distinct populations, each related to different valleys and ecosystems; they belong to three hydrographic systems that are separated by several mountain ranges and are influenced by distinctive climatic conditions.

SYAGRUS C. MARTIUS

Syagrus is most diverse in central Brazil and is usually found in dry habitats. Its 32 species range from Venezuela and Colombia to Argentina with a further species in the Antilles (Glassman, 1987). An ongoing revision of the genus will report more species (L. Noblick, pers. comm.). This genus is characterized by a wide variety of life forms and habits; its species occupy both the understory and the canopy. It has an aboveground stem or may be acaulescent, the inflorescence is branched or spicate and interfoliar, the pinnate leaves are regularly or irregularly spaced, and all the species have six stamens.

The following species, *Syagrus yungasensis* is described as new to science. None of the species reported by Glassman (1987) have the combination of branched inflorescences, irregularly inserted pinnae, numerous rachillae, and treelike habit. The size of the pistillate flowers and the ornamentation of a three-ridged endocarp are reminiscent of another Bolivian species, *S. cardenasii*, but many other characters differ as follows:

KEY TO *SYAGRUS CARDENASII* GLASSMAN AND *S. YUNGASENSIS*

- 1. Endocarp 3 mm thick, smooth and glabrous, slightly beaked apically; endocarp apex terminates in a 3-lobed little apical point; rachillae 9–11, spreading; stem to 3 cm diam., covered with sheaths or acaulescent; ovary tomentose *S. cardenasii*
- 1. Endocarp 5 mm thick, rough and covered with coarse fibers, beaked basally; endocarp apex terminates in three prominent ridges that stop short of apex; rachillae 32–46, appressed to rachis; stem 7–9 cm diam., smooth; ovary glabrous *S. yungasensis*

Syagrus yungasensis Moraes, sp. nov. TYPE: Bolivia. La Paz: Sud Yungas, 30 km on the road from Chulumani to La Asunta, 900 m, 9 Dec. 1994, M. Moraes 1874 (holotype, LPB; isotypes, FTG, NY). Figure 3.

Caudex solitarius 4–5 m. Pinnae utroque latere 98–120, irregulariter dispositae vel 4–10 aggregatae ad me-

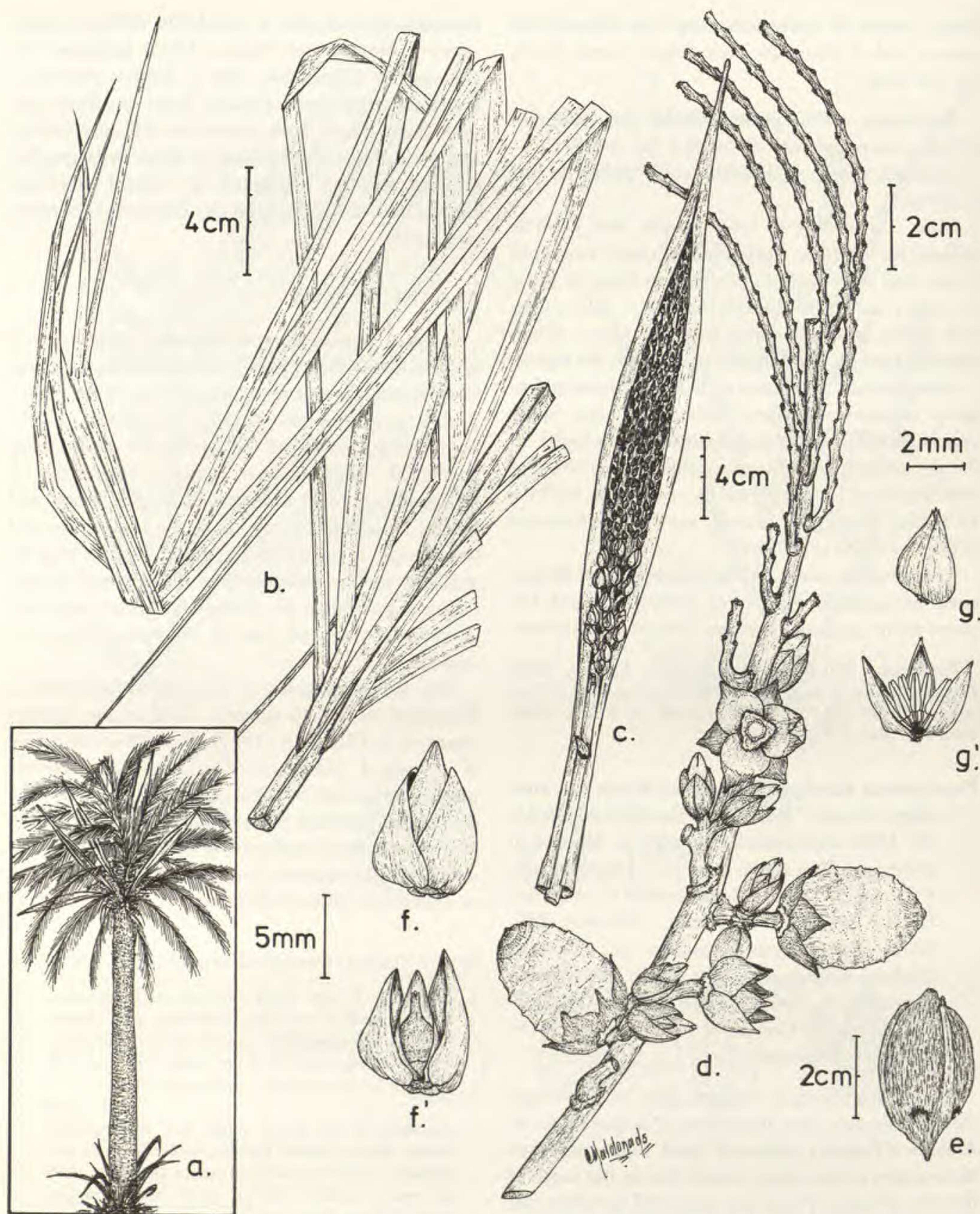


Figure 3. *Syagrus yungasensis* Moraes. —a. Habit with several erect inflorescences. —b. Shape and arrangement of middle section of leaves. —c. Inflorescence; note pistillate flowers in proximal rachillae. —d. Infructescence with mature fruits. —e. Endocarp. —f. Pistillate flower. —f'. Open perianth showing ovary and staminodial ring. —g. Staminate flower. —g'. Open flower showing stamens. (a based on photographs taken on the road from Chulumani to La Asunta, La Paz; b–g on Moraes 1874.)

dium usque foliato. Rhachilla 32–46 appressus ad rhachim, flores feminei congesti ad rhachillae basim.

Stem solitary 4–5 m tall, 7–9 cm diam., smooth surface with overlapping internodes without foliar bases. Leaves 13–18, ca. 2.2 m long; sheath 12–25 cm long, fibrous; pseudopetiole 80–100 cm long, fibrous, channeled with slightly raised midridge, margins with fibers 6–8 cm long; rachis 1.2–1.4 m long, triangular in cross section at apex; pinnae 98–120 per side, lanceolate, irregularly inserted in groups of 4–10, 4–6 cm apart, open, nearly perpendicular to rachis, plicate at base, green and lustrous adaxially, glabrous with ramenta on central nerve abaxially, in each group the apical pinnae erect to apex; basal pinnae 39–68 × 0.4–0.5 cm; middle pinnae 45–63 × 1–1.2 cm; apical pinnae 4–15 × 0.1–0.2 cm. Inflorescences up to 8 per plant, 40–95 cm long; prophyll 16 cm long, fibrous; peduncular bract 80–92 cm long, apiculate, inflated above, woody, sulcate, brown externally, glabrous and dark brown internally; peduncle 56 cm long, glabrous; rachis 10–13 cm long, glabrous; rachillae 32–46, appressed to rachis, 11–15 bearing 2–4 pistillate flowers, the remaining rachillae with only staminate flowers, basal ca. 8–26 cm long and apical 2.5–10 cm long; sometimes one single rachilla inserted 40 cm from the base of peduncle, with 5–6 pistillate flowers. Staminate flowers sessile, to 6 mm long; sepals and petals apiculate; stamens 6, 2–3 mm long; filaments to 1 mm long; anthers to 2 mm long. Pistillate flowers 9–10 mm; sepals and petals apiculate; ovary glabrous with trifid stigmas; staminodial ring to 2 mm high, undulate. Fruit 3.5–4 × 2.5–3 cm; epicarp smooth, green with brown scales at apex; mesocarp fibrous; endocarp 5 mm thick covered with persistent coarse fibers, rough surface, beaked at the base and with lightly prominent ridges that stop short of apex; seed 1, endosperm homogenous.

Etymology. The specific epithet refers to the geographical region known locally as the Yungas, an area that comprises much of the east slope of the Andes in northern and central Bolivia.

Common names and uses. None recorded.

Distribution. Restricted to narrow dry valleys and steep rocky slopes in the semideciduous forests of the eastern slope of the Andes, between 700 and 1000 m elevation.

Conservation status. This species is only known from narrow valleys. Due to an increasing number of vehicles and road construction in the area its population could be endangered. However, most populations are found on inaccessible, steep slopes and are not thought to be in any immediate danger.

Paratype. BOLIVIA. La Paz: Sud Yungas, 82 km from Chulumani on road to La Asunta, 700 m, 30 May 1986, Beck 12636 (LPB).

Syagrus yungasensis was found on the stretch of road between Chulumani and La Asunta growing on rocky soils and cliff faces in steep ravines. These dry interandean valleys are very different from the humid forests found in much of the Yungas, and are a result of orographic conditions. The linear distance from the collection sites to peaks of ca. 6500 m in elevation in the Cordillera is ca. 55 kilometers. The population is found within rain-shadowed valleys, and the vegetation is characterized by the presence of semideciduous and xerophytic species that withstand extended periods without rain.

Small species of *Syagrus* often turn out to be local endemics, such as in the northeast of Brazil (Larry Noblick, pers. comm.). Some acaulescent endemic species were reported from Brazil: *S. duartei* Glassman, *S. harleyi* Glassman, *S. mendanhsensis* Glassman, *S. microphylla* Burret, and *S. werdermannii* Burret (Glassman, 1987). This new small species may have evolved in recent geologic periods; it has survived in a restricted habitat that is biogeographically related to the Chaqueñan flora further south, but separated by the more humid forests of the Yungas and Chapare.

Acknowledgments. This research was supported in part by grant HRN-5600-G-00-2026-00, Program in Science and Technology Cooperation, USAID, through the project Sustainable Use, Diversity, Conservation Status, and Economic Potential of Bolivian Palms; and in part under grant 104.Dan.8.L/201 to Henrik Balslev from Danida (Danish International Development Aid). I am grateful to Eduardo Oviedo from the Herbario Nacional de Bolivia (LPB), Israel Vargas from the Herbario del Oriente Boliviano (UCZ), and to Oscar Murguía who helped me during fieldwork in Chuquisaca and Santa Cruz. The illustrations were made by Carlos Maldonado from the Herbario Nacional de Bolivia (LPB). I appreciate the helpful comments on earlier versions of Larry R. Noblick from The Montgomery Foundation, and Dan Nicolson from the Department of Botany of the Smithsonian Institution (US). Finally, I extend my gratitude to the reviewers.

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